United States Naval Academy
Mechanical Engineering Department

EM458 Failure Analysis

Catalog Description: EM458 Failure Analysis **Credit:** 3 (3-0-3)

A course deigned to introduce the student to the principles, tools and techniques used in the analysis of materials failures. Laboratory skills in non-destructive testing, optical and electron microscopy, mechanical testing, corrosion and wear testing are developed. Emphasis is placed on actual case histories and the student is required to complete analysis of a failed component.

Prerequisites: Materials Science, Strength of Materials
Corequisites: None

Textbooks: A.K.Das, Metallurgy of Failure Analysis
ASM Handbook Vol 11
Library Reserve Materials *On Reserve in Nimitz Library*

Course Director: Associate Prof. Angela Moran

Objectives[1]:

1. distinguish between cause and mode of failure. (a,b,c)
2. given a failed material component, identify possible modes of failure and outline experimental tasks and inspection methods required to select the correct mode. (a,b,c,d)
3. collect all necessary facts and information to recreate the environmental factors, operator errors, design flaws, processing effects or maintenance mistakes that may have contributed to the failure of the component. (a,b,c)
4. present an engineering analysis in clear and technically correct terms. (a,b,c,d)
5. understand a broad range of investigation techniques used by engineers to characterize materials failures. (a,b,c)
6. make competent decisions on material selection, based on designed operating and environmental conditions. (a,b,c)

Course Content:

No.	Topic or Subtopic	hrs.
1	General Practice In Failures Analysis	3
2	Case Studies	3
3	Data Gathering	1
4	Test Plan Development	2
5	Non - Destructive Testing	3
6	Metallography	3
7	Fractography	3
8	Mechanical Properties	1
9	Fracture And Fracture Toughness	2
10	Fatigue Failures	2
11	Influence Of Processing	3
12	Environmental Factors/Wear	3
13	Elevated Temperature Failures	3
14	Failures Of Weldments	3
15	Failures Of Shafts	3
16	Component Analysis	8

Evaluation:

1. Exams
2. Homework
3. Lab reports
4. In class work
5. Group project

Acquired Abilities[2]:

1. identify possible cause and modes of failure and outline experimental tasks and inspection methods required to select the correct mode. (1-5)
2. recreate the environmental factors, operator errors, design flaws, processing effects or maintenance mistakes that may have contributed to the failure of the component. (3-5)
3. present an engineering analysis in clear and technically correct terms. (3,5)

4. demonstrate a broad range of investigation techniques used by engineers to characterize materials failures. (3,5)

Date of Latest Revision: 24 OCT 2001

[1] Letters in parenthesis refer to the Program Objectives of the Mechanical Engineering Program.
[2] Numbers in parenthesis refer to the evaluation methods used to assess student performance.